

## **REMARKS**

Claims 1-2, 5-12, 14, and 17-18 are pending in the application. Claims 1, 8, 9, 10, and 14 are currently amended to separate claim elements by line indentation and for clarity in order to overcome claim objections and/or rejections under 35 U.S.C. § 112. Claim 19 is presently cancelled and claims 3, 4, 13, 15, and 16 were previously cancelled. Entry of the claim amendments is requested as the scope of the claims is unchanged and the amendments serve to place the claims in better form for appeal, as permitted under 37 C.F.R. § 1.116.

The Examiner is respectfully requested to reconsider and withdraw the rejections in view of the amendments and remarks contained herein.

### **1. SPECIFICATION**

The disclosure is objected to for various informalities. Applicant has amended the disclosure according to the Examiner's suggestions to include section headings and cross-reference to related applications. Therefore, reconsideration and withdrawal of the objections are respectfully requested.

### **2. CLAIM OBJECTIONS**

Claims 1, 8, and 14 are objected to for various informalities. Claims 1, 8, and 14 are currently amended to separate claim elements by line indentation. Claim 14 is further amended to remove "such as a rotor or stator" from the preamble. Reconsideration and withdrawal of the objections are respectfully requested.

### **3. REJECTIONS UNDER 35 U.S.C. § 112**

Claim 9-10 and 19 are rejected under 35 U.S.C. § 112, second paragraph, as allegedly indefinite for failing to particularly point and distinctly claim the subject matter which Applicant regards as the invention.

Claims 9 and 10 are amended to recite “said ceramic coating” to clarify antecedent basis for the claimed features. Claim 19 is cancelled, rendering the rejection moot as applied to this claim. In view of these amendments, reconsideration and withdrawal of the rejection are respectfully requested.

### **4. REJECTION UNDER 35 U.S.C. § 102**

Claims 1-2, 5-12, 14 and 17-18 stand rejected under 35 U.S.C. § 102(b) as allegedly anticipated by Qadri et al (U.S. Pat. No. 5,800,934). This rejection is respectfully traversed.

Independent claims 1, 8, and 14 are novel over Qadri as the document fails to provide a method for preventing rumpling of metallic components, as required by *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987) (each and every element in the claim must be present in the reference for the claim to be anticipated); and *Bell Communications Research, Inc. v. Vitalink Communications Corp.*, 55 F.3d 615, 620, 34 USPQ2D (BNA) 1816, 1820 (Fed. Cir. 1995) (claim preamble has the import that the claim as a whole suggests for it). While the coating materials and the layers in Qadri may be similar to the presently claimed features, the Qadri document is silent regarding their particular use to prevent rumpling of metallic components. Notably, the present claims are not directed to the compositions themselves, but instead to their use to prevent rumpling in situations where the claimed thicknesses (i.e., less than 50  $\mu\text{m}$ ) have substantially no heat-insulating effect.

Specification page 3, lines 18-21. For example, substrate portions without the ceramic coating comprising zirconia are roughened (i.e., rumpled) in comparison to covered portions following heat cycles. Specification page 5, lines 13-16.

In particular, the focus of Qadri is not to prevent rumpling. Instead, Qadri is focused on suppressing the martensitic phase transformation (from tetragonal to monoclinic) of zirconia using zinc oxide, thereby preventing coating disintegration following heat cycles in a thermal barrier coating. Qadri col. 1, lines 9-11 and lines 35-38; and col. 1, line 66 to col. 2, line 2. As such, the Qadri coatings are applied in situations requiring an effective thermal barrier that prevents the martensitic phase transformation (from tetragonal to monoclinic) of zirconia caused by heat exposure and heat cycles. Qadri col. 1, lines 26-38. “The stabilized zirconia of [the Qadri] invention is particularly important for thermal barrier applications . . . where high temperatures with or without [a corrosive] environment, are encountered.” Qadri col. 3, lines 55-62. A person of ordinary skill in the art would not use the Qadri disclosure to prevent rumpling where the coatings provide substantially no heat-insulating effect. Qadri therefore does not provide all of the claimed features and is not anticipatory.

Reconsideration of the claims and withdrawal of the rejection are respectfully requested.

## **5. REJECTION UNDER 35 U.S.C. § 103**

Claims 1-2, 5-12, 14, and 17-18 stands rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Rigney et al. (U.S. Pat. No. 6,455,167) in view of Qadri et al. (U.S. Pat. No. 5,800,934), Strangman et al (U.S. Pat. No. 5,015,502) and Ulion et al (U.S. Pat. No. 5,262,245). This rejection is respectfully traversed.

Independent claims 1, 8, and 14 are not *prima facie* obvious over the cited documents as the combination fails to provide all of the claimed features and there is no apparent reason to modify the combination to include the missing subject matter. See *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991) (combined references must teach or suggest all the claim limitations to establish a *prima facie* case of obviousness); and *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418, 82 USPQ2d 1385, 1396 (2007) (obviousness includes determining whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue). In particular, the combination lacks any basis for a skilled artisan to apply coatings in a way that results in substantially no heat-insulating effect but prevents rumpling. The cited documents instead follow the conventional belief that greater thicknesses are necessary to increase the effectiveness of a thermal barrier coating. The present claims consequently controvert conventional wisdom and provide unexpected results.

The various Rigney, Qadri, Strangman, and Ulion documents recognize that thermal barrier effects and heat resistance are a result effective variable in that a thicker coating provides more heat resistance. That is, thickness *per se* is not a result effective variable that is optimized alone; thickness is optimized in direct relation to the desired thermal barrier effectiveness. Thus, the conventional wisdom is that when the intended application requires more heat resistance, one makes the coating thicker to account for the extra heat and provide a better thermal barrier. This is the premise for the thermal barrier coatings in the cited documents, along with additional twists such as a diffusion barrier layer (i.e., Rigney), stabilization of zirconia with zinc oxide (i.e., Qadri), an interlayer of alumina (i.e., Strangman), and polishing the alumina containing layer prior to applying the ceramic layer (Ulion). Accordingly, a constant tenet of the cited documents is that coating thickness should be increased as expected heat exposure increases.

For example, in Strangman, the thickness for the ceramic layer can be 1 to 1000 microns, but the functional region for most thermal barrier applications is limited to 50 to 300 microns. Strangman col. 6, lines 1-2.

In the response to arguments, the Office acknowledges that the Rigney, Qadri, Strangman, and Ulion documents do not discuss suppression of wrinkling/rumpling. Office Action dated March 30, 2010 at page 14, lines 5-6. The known coatings in these documents are all used as thermal barrier coatings and are thus only known and used in higher thicknesses. Thinner coatings, such as those employed in the present claims, do not result in thermal barrier coatings. The present claims do not provide a thermal barrier (i.e., thicknesses less than 50  $\mu\text{m}$  have substantially no heat-insulating effect), but do provide a reduction in rumpling, which until now was unappreciated in the art. Throughout the literature, only the thermal barrier effectiveness is stressed and consequently only thicker layers have been used in high heat applications. These thick layers also suppress rumpling, but until now no one has suggested using thinner layers to suppress rumpling, even in special cases where thick layers are not wanted or not possible, wherein rumpling is nevertheless still a problem.

In addition, a person of skill in the art of thermal barrier coatings would have no reason to recreate the present methods based on the cited documents and employ such thin layers, as the claimed thickness does not provide the desired effect, being a thermal barrier. This can be illustrated by the relationship of temperature difference = heat flow / (thermal conductivity  $\times$  thickness). The thermal conductivity of a thermal barrier coating is usually in the range of 2 W/mK. For a typical heat flow of about 1 MW/m<sup>2</sup> through the wall of a turbine blade, there will be a temperature difference of about 0.5 degrees C for 1 micron of a thermal barrier coating. Thus, having a coating thickness of 10 microns, there will be a temperature difference of 5°C,

accordingly a thickness of 25 microns results in a temperature difference of 12.5°C, and a thickness of 50 microns results in a temperature difference of 25°C. Having a temperature difference of less than 10°C, a person of skill in the art would never add a thermal barrier coating to a surface in this case.

It is also surprising and unexpected that a coating resistant to wrinkling (rumpling) could be achieved by using the thin layers of ceramic as presently claimed. The benefits of the present claims are not predictable in view of the combination of Rigney, Qadri, Strangman, and Ulion. “The combination of familiar elements according to known methods is likely to be obvious *when it does no more than yield predictable results.*” *Id.*, emphasis added. “The operative question in this ‘functional approach’ is thus ‘whether the improvement is more than the predictable use of prior art elements according to their established functions.’” *Ex Parte Smith*, Appeal No. 2007-1925 (Bd. Pat. App. & Int. June 25, 2007) quoting *KSR* at 1740. Here, it could not have been predicted by a person of ordinary skill in the art that the presently claimed thin layer of ceramic applied onto an aluminum-containing metallic oxidation protection coating could prevent thermally influenced wrinkling (rumpling).

Finally, the Office Action posits that “[t]here is nothing in the art or evidence submitted by Applicant to suggest the reduction in wrinkling/rumpling is not a latent property of the coatings disclosed in the prior art.” Office Action dated March 30, 2010 at page 14, lines 8-10. The Office appears to be suggesting that combination of the cited documents would inherently result in a reduction of wrinkling/rumpling. However, there is no identified basis to first controvert the established tenet of increasing thickness to increase thermal barrier effectiveness, as set out in the cited documents. Second, obviousness cannot be predicated on what is unknown and unappreciated. See *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir.

1993) (reversed rejection because inherency was based on what would result due to optimization of conditions, not what was necessarily present in the prior art); *In re Oelrich*, 666 F.2d 578, 581-82, 212 USPQ 323, 326 (CCPA 1981) (inherency may not be established by probabilities or possibilities and the mere fact that a certain thing may result from a given set of circumstances is not sufficient). In this case, only Applicant's disclosure recognizes that rumpling can be prevented using a ceramic thickness (i.e., less than 50  $\mu\text{m}$ ) that provides substantially no heat-insulating effect. Thus, the cited documents cannot establish a case of obviousness.

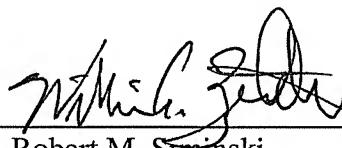
Applicants respectfully request reconsideration of the claims and withdrawal of the rejection.

## **6. CONCLUSION**

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action and the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

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